# TERRA GRANDE WATER COMPANY (PWS 4010147)
# SOURCE WATER ASSESSMENT FINAL REPORT

**June 7, 2002**

**State of Idaho**
**Department of Environmental Quality**

## Executive Summary

Under the Safe Drinking Water Act Amendments of 1996, all states are required by the U.S. Environmental Protection Agency (EPA) to assess every source of public drinking water for its relative sensitivity to contaminants regulated by the Act. This assessment is based on a land use inventory of the designated assessment area and sensitivity factors associated with the wells and aquifer characteristics.

This report, *Source Water Assessment for Terra Grande Water Company, Boise, Idaho,* describes the public drinking water system, the boundaries of the zones of water contribution, and the associated potential contaminant sources located within these boundaries. This assessment should be used as a planning tool, taken into account with local knowledge and concerns, to develop and implement appropriate protection measures for this source. **The results should not be used as an absolute measure of risk and they should not be used to undermine public confidence in the water system.**

Final susceptibility scores are derived from equally weighting system construction scores, hydrologic sensitivity scores, and potential contaminant/land use scores. Therefore, a low rating in one or two categories coupled with a higher rating in other categories results in a final rating of low, moderate, or high susceptibility. With the potential contaminants associated with most urban and heavily agricultural areas, the best score a well can get is moderate. Potential contaminants are divided into four categories, inorganic contaminants (IOCs, i.e. nitrates, arsenic), volatile organic contaminants (VOCs, i.e. petroleum products), synthetic organic contaminants (SOCs, i.e. pesticides), and microbial contaminants (i.e. bacteria). As different wells can be subject to various contamination settings, separate scores are given for each type of contaminant.

The Terra Grande Water Company drinking water system consists of three wells that serve approximately 111 households in the Terra Grande subdivision. All of the wells have a high susceptibility to all potential contaminants. Well #2 rates automatically high due to Ash Park Road that runs within 50 feet of the wellhead. All of the wells have an automatic high susceptibility to VOCs due to detections of VOCs in the wells from 1995 to 2001. The lack of a proper wellhead seal on Well #2 and the absence of proper casing vents for all of the wells contributed to the high system construction score and influenced the overall susceptibility of the wells. The soil composition of Well #2 lacked a sufficient amount of clay layers resulting in a high hydrologic sensitivity score and adding to the high overall susceptibility of the well. The large number of potential contaminant sources contained in the delineation of the wells also contributed to the high overall susceptibility of the wells.

The current water chemistry problems that affect the Terra Grande Water Company water system pertain to the detection of VOCs in all three wells. The VOC 1,1,1-trichloroethane was detected in Well #1 in February 1996, November 2000, and December 2001, in Well #2 in September 1995, and in Well #3 in September 1995, February 1996, and November 2000. The VOC 1,1-dichloroethylene was also detected in Well #1 and Well #3 in November 2000. Two other VOCs (cis-1,2-dichloroethylene and trichloroethylene) were detected in Well #1 in November 2000. Health effects from acute exposure via drinking water to these VOCs may range from vomiting and abdominal pain to liver damage.

No SOCs or coliform bacteria have been detected in the drinking water system. The IOCs barium, fluoride, mercury, and selenium have been detected in the wells at levels below the maximum contaminant levels (MCLs). Arsenic has been detected in Well #1 at 12 parts per billion (ppb), a level greater than the newly revised MCL of 10 ppb. In October 2001, the EPA lowered the arsenic MCL from 50 ppb to 10 ppb, giving public water systems until 2006 to comply with the new standard. Arsenic has also been detected in Wells #2 and #3 at levels as high as 9 ppb, greater than one-half the current MCL. Nitrate has also been detected in all three wells at levels greater than one-half the MCL of 10 parts per million (ppm). Graph 1 in Appendix A shows the nitrate levels in all three wells from 1995 to 2001. The nitrate levels in Well #2 appear to be decreasing over time. However, they appear to be increasing in Well #1 and Well #3. Additionally, though the land use is predominantly urban, the delineation crosses priority areas for nitrate and the pesticides atrazine and alachlor.

This assessment should be used as a basis for determining appropriate new protection measures or re-evaluating existing protection efforts. No matter what ranking a source receives, protection is always important. Whether the source is currently located in a “pristine” area or an area with numerous industrial and/or agricultural land uses that require surveillance, the way to ensure good water quality in the future is to act now to protect valuable water supply resources. If the system should need to expand in the future, new well sites should be located in areas with as few potential sources of contamination as possible, and the site should be reserved and protected for this specific use.

For the Terra Grande Water Company, drinking water protection activities should first focus on correcting any deficiencies outlined in the sanitary survey (an inspection conducted every five years with the purpose of determining the physical condition of a water system’s components and its capacity). No application or storage of herbicides, pesticides, or other chemicals is allowed within 50 feet of the wellheads. The use of Ash Park Road that runs within 50 feet of Well #2 may need to be limited to avoid potential contamination associated with accidental spills or releases. Since the delineation underlies urban and residential land, storm water drainage may also be an important consideration. Should microbial contamination become a problem, appropriate disinfection practices will need to be implemented. Much of the designated protection areas are outside the direct jurisdiction of the Terra Grande Water Company, making collaboration and partnerships with state and local agencies and industry groups critical to the success of drinking water protection.

The Terra Grande Water Company may need to investigate the cause of the VOC contamination in the wells. The Water Company also may want to consider future engineering controls to detect and reduce VOC contamination in the drinking water system. Engineering controls could also be used to control the levels of arsenic and nitrate in the drinking water. For the new arsenic standard, the EPA intends to provide up to $20 million over the next two years for research and development of more cost-effective technologies to help small systems meet the new standard and provide technical assistance to small system operators. The EPA has also stated that it “will work with small communities to maximize grants and loans under current State Revolving Fund and Rural Utilities Service programs of the Department of Agriculture.” (USEPA, 2001, para 5).

Due to the time involved with the movement of ground water, drinking water protection activities should be aimed at long-term management strategies even though these strategies may not yield results in the near term. A strong public education program should be a primary focus of any drinking water protection plan as the delineation contain some urban and residential land uses. Public education topics could include proper lawn and garden care practices, household hazardous waste disposal methods, proper care and maintenance of septic systems, and the importance of water conservation to name but a few. There are multiple resources available to help communities implement protection programs, including the Drinking Water Academy of the EPA. As there are transportation corridors around the delineation, the Idaho Department of Transportation should also be involved in protection activities. Drinking water protection activities for agriculture should be coordinated with the Idaho State Department of Agriculture, the Soil Conservation Commission, the Ada Soil and Water Conservation District, and the Natural Resources Conservation Service.

A community must incorporate a variety of strategies in order to develop a comprehensive drinking water protection plan, be they regulatory in nature (i.e. zoning, permitting) or non-regulatory in nature (i.e. good housekeeping, public education, specific best management practices). For assistance in developing protection strategies please contact the Boise Regional Office of the Idaho Department of Environmental Quality or the Idaho Rural Water Association.

# SOURCE WATER ASSESSMENT FOR THE TERRA GRANDE WATER COMPANY, BOISE, IDAHO

## Section 1. Introduction - Basis for Assessment

The following sections contain information necessary to understand how and why this assessment was conducted. **It is important to review this information to understand what the rankings of this assessment mean.** Maps showing the delineated source water assessment area and the inventory of significant potential sources of contamination identified within that area are included. The list of significant potential contaminant source categories and their rankings used to develop the assessment are also included.

### Background

Under the Safe Drinking Water Act Amendments of 1996, all states are required by the EPA to assess every source of public drinking water for its relative susceptibility to contaminants regulated by the Safe Drinking Water Act. This assessment is based on a land use inventory of the delineated assessment area and sensitivity factors associated with the wells and aquifer characteristics.

### Level of Accuracy and Purpose of the Assessment

Since there are over 2,900 public water sources in Idaho, there is limited time and resources to accomplish the assessments. All assessments must be completed by May of 2003. An in-depth, site-specific investigation of each significant potential source of contamination is not possible. **Therefore, this assessment should be used as a planning tool, taken into account with local knowledge and concerns, to develop and implement appropriate protection measures for this source. The results should <u>not be</u> used as an absolute measure of risk and they should <u>not be</u> used to undermine public confidence in the water system.**

The ultimate goal of the assessment is to provide data to local communities to develop a protection strategy for their drinking water supply system. The Idaho Department of Environmental Quality (DEQ) recognizes that pollution prevention activities generally require less time and money to implement than treatment of a public water supply system once it has been contaminated. DEQ encourages communities to balance resource protection with economic growth and development. The decision as to the amount and types of information necessary to develop a drinking water protection program should be determined by the local community based on its own needs and limitations. Wellhead or drinking water protection is one facet of a comprehensive growth plan, and it can complement ongoing local planning efforts.

## Section 2. Conducting the Assessment

### General Description of the Source Water Quality

The public drinking water system for the Terra Grande Water Company is comprised of three ground water wells that serve approximately 410 people through 111 connections. All of the wells are located within the Terra Grande subdivision. Well #1 is located approximately 300 feet west of Ash Park Road. Well #2 is approximately 40 feet east of Ash Park road and approximately 500 feet south of Overland Road. Well #3 is approximately 70 feet west of Penniger Road (Figure 1).

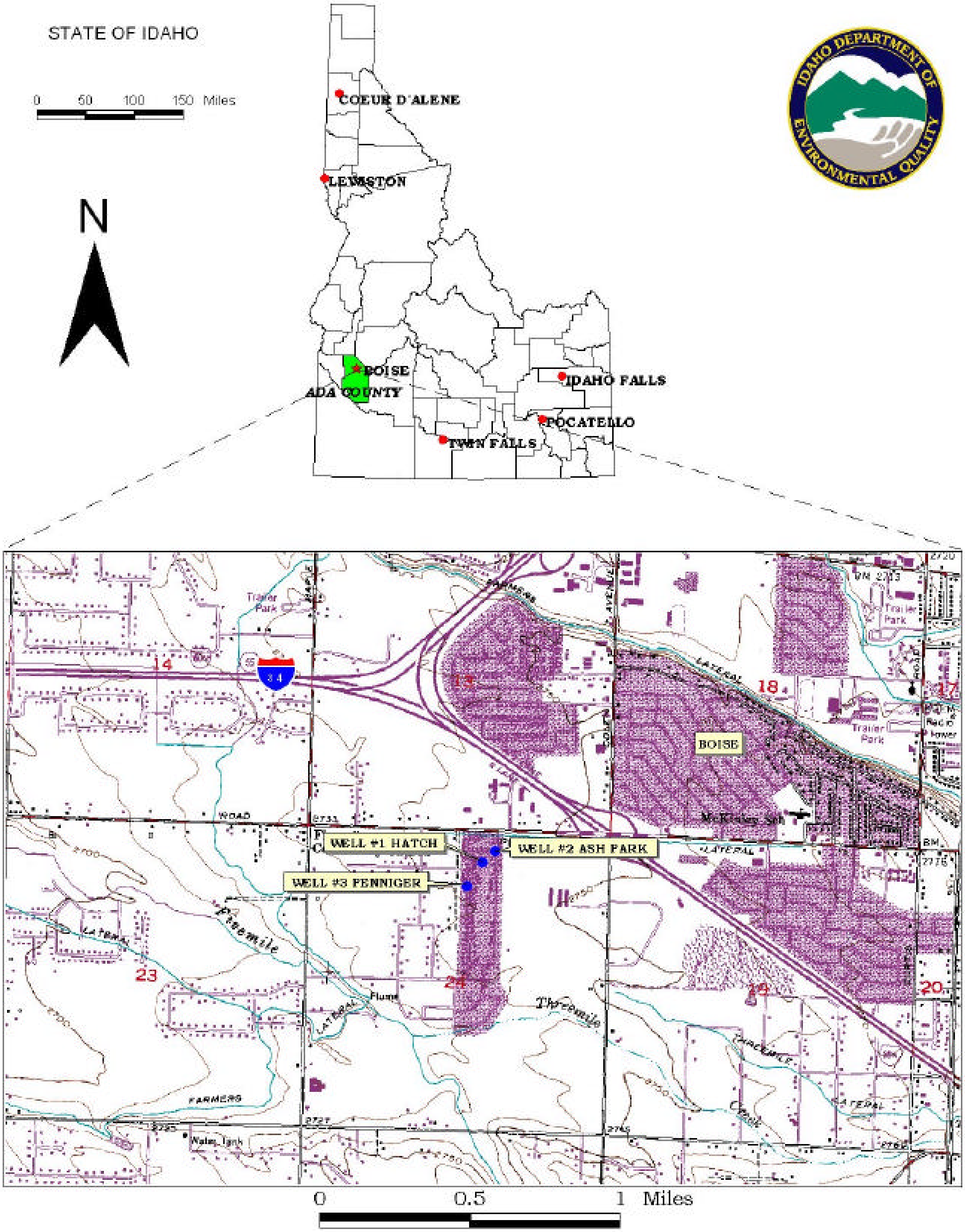
The current water chemistry problems that affect the Terra Grande Water Company water system pertain to the detection of VOCs in all three wells. The VOC 1,1,1-trichloroethane was detected in Well #1 in February 1996, November 2000, and December 2001, in Well #2 in September 1995, and in Well #3 in September 1995, February 1996, and November 2000. The VOC 1,1-dichloroethylene was also detected in Well #1 and Well #3 in November 2000. Two other VOCs (cis-1,2-dichloroethylene and trichloroethylene) were detected in Well #1 in November 2000. Health effects from acute exposure via drinking water to these VOCs may range from vomiting and abdominal pain to liver damage.

No SOCs or coliform bacteria have been detected in the drinking water system. The IOCs barium, fluoride, mercury, and selenium have been detected in the wells at levels below the MCLs. Arsenic has been detected in Well #1 at 12 ppb, a level greater than the newly revised MCL of 10 ppb. In October 2001, the EPA lowered the arsenic MCL from 50 ppb to 10 ppb, giving public water systems until 2006 to comply with the new standard. Arsenic has also been detected in Wells #2 and #3 at levels as high as 9 ppb, greater than one-half the current MCL. Nitrate has also been detected in all three wells at levels greater than one-half the MCL of 10 ppm. Graph 1 in Appendix A shows the nitrate levels in all three wells from 1995 to 2001. The nitrate levels in Well #2 appear to be decreasing over time. However, they appear to be increasing in Well #1 and Well #3. Additionally, though the land use is predominantly urban, the delineation crosses priority areas for nitrate and the pesticides atrazine and alachlor.

### Defining the Zones of Contribution – Delineation

The delineation process establishes the physical area around a well that will become the focal point of the assessment. The process includes mapping the boundaries of the zone of contribution into time-of-travel (TOT) zones (zones indicating the number of years necessary for a particle of water to reach a well) for water in the aquifer. DEQ contracted with BARR Engineering to perform the delineations using a combination of MODFLOW and a refined analytical element computer model approved by the EPA in determining the 3-year (Zone 1B), 6-year (Zone 2), and 10-year (Zone 3) TOT for water associated with the Boise Valley aquifer in the vicinity of the Terra Grande Water Company. The computer models used site specific data, assimilated by BARR Engineering from a variety of sources including the Terra Grande Water Company well logs, other local area well logs, the Treasure Valley Hydrologic Project, and hydrogeologic reports (detailed below).

## *FIGURE 1. Geographic Location of Terra Grande Water Company*



**Treasure Valley Hydrologic Project Information (Petrich and Urban, 1996; Neely and Crockett, 1998; Petrich et al., 1999)**

The “Treasure Valley” is a geopolitical region that includes the lower Boise River sub-basin. The lower Boise River sub-basin begins where the Boise River exits the mountains near the Lucky Peak Reservoir. From Lucky Peak Dam the lower Boise River flows about 64 (river) miles northwestward through the Treasure Valley to its confluence with the Snake River. The Treasure Valley Hydrologic Project area encompasses the lower Boise River area, and extends south to the Snake River. The southern area is included in the study area because of ground water flow from the Lower Boise River basin south toward the Snake River.

Significant amounts of desert area were converted to flood irrigated agriculture beginning in the 1860s. Irrigation led to increases in shallow ground water levels in some areas. The shallow groundwater levels provided an inexpensive and readily obtainable water supply that is used extensively throughout the valley. Much of the population growth in the Treasure Valley has been occurring in previously flood-irrigated agricultural areas, resulting in increased pumpage and a reduction in local aquifer recharge. In addition, irrigation in some areas has become more efficient, reducing the amount of irrigation-related infiltration. Decreasing aquifer recharge and increasing pumpage is thought to be contributing to decreasing ground water levels in some areas.

The Treasure Valley experiences a temperate and arid-to-semiarid climate. Average high temperatures range from about 90°F in summer to 36°F in winter; low temperatures range from about 20°F in winter to about 56°F in summer. The average precipitation ranges from about 8 to 14 inches throughout most of the valley, most of which falls during the colder months.

Major surface water bodies include the Boise River, Lake Lowell, and Lucky Peak Reservoir. The primary source of surface water in the Treasure Valley is precipitation falling in the high elevation area in the Boise River basin upstream of Lucky Peak Dam. Much of the runoff from high elevation areas is stored in three reservoirs: Anderson Ranch Reservoir, Arrowrock Reservoir, and Lucky Peak Reservoir.

The region’s croplands are irrigated primarily with surface water through an extensive network of reservoirs and canals. The first canals were constructed in the 1860’s; there are now over 1,100 miles of major and intermediate canals in the Treasure Valley. The primary sources of the irrigation water in the Treasure Valley include the Boise, Snake, and Payette Rivers. The majority of canals are owned and maintained by canal companies and irrigation districts.

**Hydrogeology (from Petrich et al., 1999)**

The lower Boise River sub-basin (Treasure Valley) is located within the northwest-trending topographic depression known as the western Snake River Plain. The western Snake River Plain is a relatively flat lowland separating Cretaceous granitic mountains of west-central Idaho from the granitic/volcanic Owyhee mountains in southwestern Idaho. The western Snake River Plain extends from about Twin Falls, Idaho northwestward to Vale, Oregon. The Snake River Plain is about 30 miles wide in the section containing the lower Boise River.

Sediments originating from the surrounding mountains began accumulating on top of thick, basal basalts. Rifting and continued subsidence maintained the lowland topography, leading to the additional accumulation of water and sediments (Othberg, 1994). Basin infilling by sediments and basalt occurred from the late Miocene through the late Pliocene (Othberg, 1994). Incision caused by flowing water in major drainages (e.g., Snake and Boise Rivers) began in the late Pliocene or early Pleistocene, although deposition of coarse sediments continued during Quaternary glaciations (Othberg, 1994).

Several Quaternary basalt flows have been described in the western Snake River Plain, and have been assigned to the upper Snake River Group (Malde, 1991; Malde and Powers, 1962). Lava flowed across portions of the ancestral Snake River Valley (Malde, 1991) in an area that is now south of the Boise River. The Snake River then changed course, incising at its present location along the southern margin of the basalt flows. More recent eruptions (from Kuna Butte and other local sources) spilled lava into the canyon south of Melba. The Snake River has since incised this basalt (Malde, 1991).

The general stratigraphy of the western Snake River Plain consists of (from top to bottom) a thick layer of sedimentary deposits underlain by a thick series of basalt flows, which in turn are underlain by older, tuffaceous sediments and basalt (Malde, 1991; Clemens, 1993). The upper thick zone of sediments (up to approximately 6,000 feet thick) distinguishes the western Snake River Plain from the eastern Snake River Plain, in which the upper section is primarily Quaternary basalt (Wood and Anderson, 1981).

The uppermost sediments and basalt belong to the Pleistocene-age Snake River Group. The Snake River Group consists of terrace sediments, Quaternary alluvium, and Pleistocene basalt flows (Wood and Anderson, 1981). Snake River Group sediments and basalts cover much of the project area (Othberg and Stanford, 1992).

The Snake River Group overlies the Idaho Group sediments. The Idaho Group sediments can be divided into two general parts (Wood and Anderson, 1981). The lower Idaho Group contains sediments described as lake and stream deposits of buff white, brown, and gray sand, silt, clay, diatomite, numerous thin beds of vitric ash, and some basaltic tuffs. The upper part of the lower Idaho Group also contains some local, thin, basalt flows. The upper Idaho Group consists of sands, claystones, and siltstones, but differs from the lower Idaho Group in that it contains a greater percentage of coarser-grained materials. The upper Idaho Group are associated with a fluvial/deltaic/lacustrine depositional environment; the lower Idaho Group sediments were deposited in more of a lacustrine/deltaic environment (Wood, 1994).

Wood (1994) identified a buried lacustrine delta within the Idaho Group sediments in the Nampa-Caldwell area. The location of the delta in the middle of the western Snake River Plain suggests that the eastern part of the Boise River basin was delta plain and flood plain at the time of deposition, while the western part was a deep lake environment. The delta probably prograded northwestward into a lake basin 830 feet deep based upon high-resolution seismic reflection data and resistivity log interpretations. The delta-plain and front sediments were shown to be mostly fine-grained, well-sorted sand with thin layers of mud (Wood, 1994). The northwest trend of the delta indicates a sediment source to the southeast, such as where the Snake River flows today (Wood, 1994).

A substantial, laterally extensive layer of clay is found at depths of 300 to 700 feet below ground surface. The clay is important because it represents, in some areas, a significant aquitard separating shallow overlying aquifers from deeper zones. The clay, often described in well logs as having a blue or gray color, has been observed as far west as Parma, and as far east as Boise (although the clay is not found in the extreme eastern portions of the Treasure Valley). The clay varies from a few feet to a few hundred feet in thickness. Although significant layers of clay are present throughout the Idaho Group sediments, individual clay units are not necessarily continuous over large areas. Also, the top of the clay can vary in elevation by up to approximately 200 feet in some locations, such as in an area west of Lake Lowell. In general, sediments above the "blue clay" are coarser-grained than the interbedded sands, silts, and clays underlying the "blue clay."

The top of the upper Idaho Group is marked in several parts of the Treasure Valley by a widespread fluvial gravel deposit known as the Tenmile Gravels. Tenmile Gravels contain rounded granitic rocks and felsic porphyries originating from the Idaho Batholith to the north and northeast. The Tenmile Gravels range up to 500 feet in thickness along the Tenmile Ridge south of Boise, but are less than 50 feet thick in the Nampa-Caldwell area (Wood and Anderson, 1981).

**Aquifer Systems and Hydrogeologic Characteristics**

Ground water for municipal, industrial, rural domestic, and irrigation uses in the Treasure Valley is drawn almost entirely from Snake River Group and Idaho Group aquifers. Many domestic wells draw water from shallow aquifers, such as those in the Snake River Group deposits. Larger production wells (for municipal and agricultural uses) draw water from the deeper Idaho Group sediments.

Aquifers contained in the Snake River and Idaho Group sediments comprise shallow and regional ground water flow systems. Shallow aquifers contained in Snake River Group sediments and basalts may belong to local flow systems. Most local flow system recharge stems from irrigation infiltration and channel (e.g., streams or canals) losses. Discharge from shallow, local flow systems often is to local drains or streams. The time from recharge to discharge in shallow flow systems (residence times) probably ranges from days to tens of years.

In contrast, regional ground water flow systems extend much deeper than local flow systems. The Treasure Valley regional flow system begins in the eastern part of the valley, as indicated by downward hydraulic gradients in the Boise Fan sediments described by Squires et al. (1992). Some water also enters the regional flow system as underflow from the Boise Foothills in the northeastern part of the valley. The regional flow system is thought to discharge primarily to the Boise and Snake Rivers in the western and southwestern parts of the valley.

Aquifer material characteristics, material heterogeneity, and structural controls influence Treasure Valley ground water flow. Coarse-grained materials (e.g., sand and gravel) in upper zones are more capable of transmitting ground water than fine-grained sediments (e.g., silt and clay). Clay and silt in the Snake River sediments can restrict vertical and/or horizontal ground water movement. Perched aquifers are created when fine-grained lenses impede downward vertical flow. A distinctive clay layer, sometimes referred to as "blue clay," is present over large portions of the valley. The clay is absent in the easternmost portions of the lower Boise River Basin, but can reach a thickness of more than 200 feet toward the central and western portions of the basin.

Sequences of interbedded sand, silt, and clay, such as the Deer Flat Surface and the upper portion of the Glenns Ferry Formation of the upper Idaho Group in the Nampa-Caldwell area, are the major water-producing aquifers in a large part of Canyon County (Anderson and Wood, 1981). The coarse-grained sediments in this zone produce water in excess of 2,000 gallons per minute (gpm).

The Terra Grande Water Company wells share the same delineation as they are in the same general location. That delineated source water assessment area can best be described as a east-southeastward trending corridor approximately 4 miles long and one mile wide following Interstate 84 through the 3-year, 6-year, and 10-year TOT zones and ending at the Boise airport (Figure 2, Appendix B). The actual data used by BARR Engineering in determining the source water assessment delineation areas are available from DEQ upon request.

**Identifying Potential Sources of Contamination**

A potential source of contamination is defined as any facility or activity that stores, uses, or produces, as a product or by-product, the contaminants regulated under the Safe Drinking Water Act and has a sufficient likelihood of releasing such contaminants at levels that could pose a concern relative to drinking water sources. The goal of the inventory process is to locate and describe those facilities, land uses, and environmental conditions that are potential sources of groundwater contamination. The locations of potential sources of contamination within the delineation areas were obtained by field surveys conducted by DEQ and from available databases.

Land use within the immediate area of the Terra Grande Water Company wellheads consists of residential land use and transportation corridors, while the surrounding area is predominantly urban and industrial.

It is important to understand that a release may never occur from a potential source of contamination provided they are using best management practices. Many potential sources of contamination are regulated at the federal level, state level, or both to reduce the risk of release. Therefore, when a business, facility, or property is identified as a potential contaminant source, this should not be interpreted to mean that this business, facility, or property is in violation of any local, state, or federal environmental law or regulation. What it does mean is that the potential for contamination exists due to the nature of the business, industry, or operation. There are a number of methods that water systems can use to work cooperatively with potential sources of contamination, including educational visits and inspections of stored materials. Many owners of such facilities may not even be aware that they are located near a public water supply well.

**Contaminant Source Inventory Process**

A two-phased contaminant inventory of the study area was conducted in February and March 2002. The first phase involved identifying and documenting potential contaminant sources within the Terra Grande Water Company source water assessment areas (Figure 2 in Appendix B) through the use of computer databases and Geographic Information System (GIS) maps developed by DEQ. The second, or enhanced, phase of the contaminant inventory involved contacting the operator to identify and add any additional potential sources in the area.

The delineated source water area for the Terra Grande Water Company wells contains over 180 sources and runs along Interstate 84, crossing the New York Canal in the 6-year TOT zone. The delineation includes sites such as leaking underground storage tank (LUST) sites, underground tank (UST) sites, automobile repair sites, sites regulated under the Resource Conservation and Recovery Act (RCRA), sites regulated under the Superfund Amendments and Reauthorization Act (SARA), and a couple of gravel pits (Table 3, Appendix B). All of these sources can add leachable contaminants to the aquifer.

## Section 3. Susceptibility Analyses

Each well's susceptibility to contamination was ranked as high, moderate, or low risk according to the following considerations: hydrologic characteristics, physical integrity of the well, land use characteristics, and potentially significant contaminant sources. The susceptibility rankings are specific to a particular potential contaminant or category of contaminants. Therefore, a high susceptibility rating relative to one potential contaminant does not mean that the well is at the same risk for all other potential contaminants. The relative ranking that is derived for each well is a qualitative, screening-level step that, in many cases, uses generalized assumptions and best professional judgement. Appendix C contains the susceptibility analysis worksheets. The following summaries describe the rationale for the susceptibility ranking.

### Hydrologic Sensitivity

The hydrologic sensitivity rating of a well is dependent upon four factors: the surface soil composition, the material in the vadose zone (between the land surface and the water table), the depth to first ground water, and the presence of a 50-foot thick fine-grained zone above the producing zone of the well. Slowly draining soils such as silt and clay typically are more protective of ground water than coarse-grained soils such as sand and gravel. Similarly, fine-grained sediments in the subsurface and a water depth of more than 300 feet protect the ground water from contamination.

Hydrologic sensitivity is moderate for Wells #1 and #3 and high for Well #2 of the Terra Grande Water Company (Table 2). Regional soils data indicate that the area is predominantly composed of moderate to well-drained soils. The vadose zones of the wells consist mostly of gravel. However, the well logs for Wells #1 and #3 indicate that several layers of clay totaling more than 50 feet are present above the producing zones, potentially decreasing the downward movement of contaminants to the aquifer.

### Well Construction

Well construction directly affects the ability of the well to protect the aquifer from contaminants. System construction scores are reduced when information shows that potential contaminants will have a more difficult time reaching the intake of the well. Lower scores imply a system is less vulnerable to contamination. For example, if the well casing and annular seal both extend into a low permeability unit, then the possibility of contamination is reduced and the system construction score goes down. If the highest production interval is more than 100 feet below the water table, then the system is considered to have better buffering capacity. If the wellhead and surface seals are maintained to standards, as outlined in sanitary surveys, then contamination down the well bore is less likely. If the well is protected from surface flooding and is outside the 100-year floodplain, then contamination from surface events is reduced. A sanitary survey was conducted in 1994.

All of the Terra Grande wells have a high system construction scores. The 1994 sanitary survey indicates that the wellhead and surface seals of Well #1 and Well #3 are maintained to standards but that the wellhead and surface seal of Well #2 needs to be repaired. The sanitary survey also indicates that a casing vent is not present on any of the wells and therefore, the wells are not properly protected from surface flooding. Table 1 provides a summary of the well construction for the Terra Grande Water Company wells.

The available well logs allow a determination as to whether current public water system (PWS) construction standards are being met. Though the wells may have been in compliance with standards when they were completed, current PWS well construction standards are more stringent. The Idaho Department of Water Resources *Well Construction Standards Rules* (1993) require all PWSs to follow DEQ standards as well. IDAPA 58.01.08.550 requires that PWSs follow the *Recommended Standards for Water Works* (1997) during construction. Some of the regulations deal with screening requirements, aquifer pump tests, surface casing vent, and thickness of casing. According to IDAPA 58.01.08, PWSs are required to have pump tests that yield less than 50 gallons per minute (gpm) for a minimum of 4 hours and greater than 50 gpm for a minimum of 6 hours. Table 1 of the *Recommended Standards for Water Works* (1997) lists the required steel casing thickness for various diameter wells. Six-inch diameter wells require a casing thickness of 0.280-inches and ten-inch diameter wells require a casing thickness of 0.365-inches. Twelve to twenty-inch diameter wells require a casing thickness of 0.375-inches. As such, the wells were assessed an additional point in the system construction rating even though they may have met standards at the time of installation.

**Table 1. Terra Grande Water Company Well Construction Summary Information**

| Well | Well Depth (ft) | Water Table Depth (ft) | Casing: diameter/ thickness (in) | Casing: depth (ft)/ formation | Surface seal: depth (ft)/ formation | Screened Interval (ft) | Drill Year | Sanitary Survey Elements (A/B) [1] |
|---|---|---|---|---|---|---|---|---|
| **Well #1** | 250 | 40 | 20/0.375<br>10/0.375<br>10/0.250 | 2/top soil<br>117/yellow clay<br>221/brown sand | 28/medium gravel | NI | 1959 (deepened in 1972) | Yes/No |
| **Well #2** | 128 | 42 | 6/NI | 122/Hard yellow clay | NI | NI | 1957 | No/No |
| **Well #3** | 164 | 45 | 6/NI | 158/yellow clay | NI | NI | 1957 | Yes/No |

**[1] A = Well and surface seal in compliance; B = Protected from surface flooding**
**NI = no information was available**

## Potential Contaminant Source and Land Use

All Terra Grande wells rate high for IOCs (i.e. nitrates, arsenic) and SOCs (i.e. pesticides), moderate for VOCs (i.e. petroleum products), and low for microbial contaminants (i.e. bacteria). The large number of potential contaminant sources that can add leachable contaminants into the aquifer and the nitrate and pesticide priority areas within the delineation contributed significantly to the land use ratings.

## Final Susceptibility Ranking

A detection above a drinking water standard MCL, any detection of a VOC or SOC, or a detection of total coliform bacteria or fecal coliform bacteria at the wellhead will automatically give a high susceptibility rating to a well despite the land use of the area because a pathway for contamination already exists. Additionally, storing potential contaminant sources within 50 feet of a wellhead will automatically lead to a high susceptibility rating. In this case, Ash Park Road runs within 50 feet of Well #2, giving Well #2 an automatic high susceptibility to all potential contaminants. Additionally, VOCs were detected in all of the wells between 1995 and 2001, giving all wells an automatic high susceptibility to VOCs. Hydrologic sensitivity and system construction scores are heavily weighted in the final scores. Having multiple potential contaminant sources in the 0- to 3-year time of travel zone (Zone 1B) and agricultural land contribute greatly to the overall ranking. In terms of total susceptibility, all of the Terra Grande Water Company wells rated high susceptibility to all potential contaminant categories.

**Table 2. Summary of Terra Grande Water Company Susceptibility Evaluation**

| Well | Susceptibility Scores[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Hydrologic Sensitivity | Contaminant Inventory | | | | System Construction | Final Susceptibility Ranking | | | |
| | | IOC | VOC | SOC | Microbials | | IOC | VOC | SOC | Microbials |
| Well #1 | M | H | M | H | L | H | H | H(*) | H | H |
| Well #2 | H | H | M | H | L | H | H(*) | H(*) | H(*) | H(*) |
| Well #3 | M | H | M | H | L | H | H | H(*) | H | H |

**[1]H = High Susceptibility, M = Moderate Susceptibility, L = Low Susceptibility,**
**IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical**
**(*) = an automatic high score due to the detection of a VOC (all wells) or the proximity of Ash Park Road within 50 feet of Well #2 as well as a high number of points resulting in a high susceptibility score**

## Susceptibility Summary

All of the Terra Grande Water Company wells have a high susceptibility to all potential contaminant categories. Well #2 rates automatically high due to Ash Park Road that runs within 50 feet of the wellhead. All of the wells have an automatic high susceptibility to VOCs due to detections of VOCs in the wells from 1995 to 2001. The lack of a proper wellhead seal on Well #2 and the absence of proper casing vents for all of the wells contributed to the high system construction scores and influenced the overall susceptibility of the wells. The soil composition of Well #2 lacked a sufficient amount of clay layers resulting in a high hydrologic sensitivity score and adding to the high overall susceptibility of the well. The large number of potential contaminant sources contained in the delineation of the wells also contributed to the high overall susceptibility of the wells to contamination.

The current water chemistry problems that affect the Terra Grande Water Company drinking water system pertain to the detection of VOCs in all three wells. The VOC 1,1,1-trichloroethane was detected in Well #1 in February 1996, November 2000, and December 2001, in Well #2 in September 1995, and in Well #3 in September 1995, February 1996, and November 2000. The VOC 1,1-dichloroethylene was also detected in Well #1 and Well #3 in November 2000. Two other VOCs (cis-1,2-dichloroethylene and trichloroethylene) were detected in Well #1 in November 2000. Health effects from acute exposure via drinking water to these VOCs may range from vomiting and abdominal pain to liver damage.

No SOCs or coliform bacteria have been detected in the drinking water system. The IOCs barium, fluoride, mercury, and selenium have been detected in the wells at levels below the MCLs. Arsenic has been detected in Well #1 at 12 ppb, a level greater than the newly revised MCL of 10 ppb. In October 2001, the EPA lowered the arsenic MCL from 50 ppb to 10 ppb, giving public water systems until 2006 to comply with the new standard. Arsenic has also been detected in Well #2 and Well #3 at levels as high as 9 ppb, greater than one-half the current MCL. Nitrate has also been detected in all three wells at levels greater than one-half the MCL of 10 ppm. Graph 1 in Appendix A shows the nitrate levels in all three wells from 1995 to 2001. The nitrate levels in Well #2 appear to be decreasing over time, however, they appear to be increasing in Well #1 and Well #3. Additionally, though the land use is predominantly urban, the delineation crosses priority areas for nitrate and the pesticides atrazine and alachlor.

## Section 4. Options for Drinking Water Protection

The susceptibility assessment should be used as a basis for determining appropriate new protection measures or re-evaluating existing protection efforts. No matter what the susceptibility ranking a source receives, protection is always important. Whether the source is currently located in a “pristine” area or an area with numerous industrial and/or agricultural land uses that require surveillance, the way to ensure good water quality in the future is to act now to protect valuable water supply resources.

An effective drinking water protection program is tailored to the particular local drinking water protection area. A community with a fully developed drinking water protection program will incorporate many strategies. For the Terra Grande Water Company, drinking water protection activities should first focus on correcting any deficiencies outlined in the sanitary survey. No application or storage of herbicides, pesticides, or other chemicals is allowed within 50 feet of the wellheads. The use of Ash Park Road that runs within 50 feet of Well #2 may need to be limited to avoid potential contamination associated with accidental spills or releases. Since the delineation underlies urban and residential land, storm water drainage may also be an important consideration. Should microbial contamination become a problem, appropriate disinfection practices will need to be implemented. Much of the designated protection areas are outside the direct jurisdiction of the Terra Grande Water Company, making collaboration and partnerships with state and local agencies and industry groups critical to the success of drinking water protection.

The Terra Grande Water Company may need to investigate the cause of the VOC contamination in the wells. It also may want to consider future engineering controls to detect and reduce the VOC contamination in the drinking water system. Engineering controls could also be used to control the levels of arsenic and nitrate in the drinking water in order to meet standards. For the new arsenic standard, the EPA intends to provide up to $20 million over the next two years for research and development of more cost-effective technologies to help small systems meet the new standard and provide technical assistance to small system operators. The EPA has also stated that it “will work with small communities to maximize grants and loans under current State Revolving Fund and Rural Utilities Service programs of the Department of Agriculture” (USEPA, 2001, para 5).

Due to the time involved with the movement of ground water, drinking water protection activities should be aimed at long-term management strategies even though these strategies may not yield results in the near term. A strong public education program should be a primary focus of any drinking water protection plan as the delineations contain some urban and residential land uses. Public education topics could include proper lawn and garden care practices, household hazardous waste disposal methods, proper care and maintenance of septic systems, and the importance of water conservation to name but a few. There are multiple resources available to help communities implement protection programs, including the Drinking Water Academy of the EPA. As there are major transportation corridors through the delineation, the Idaho Department of Transportation should be involved in protection activities. Drinking water protection activities for agriculture should be coordinated with the Idaho State Department of Agriculture, the Soil Conservation Commission, the Ada Soil and Water Conservation District, and the Natural Resources Conservation Service.

A community must incorporate a variety of strategies in order to develop a comprehensive drinking water protection plan, be they regulatory in nature (i.e. zoning, permitting) or non-regulatory in nature (i.e. good housekeeping, public education, specific best management practices). For assistance in developing protection strategies please contact the Boise Regional Office of the DEQ or the Idaho Rural Water Association.

**Assistance**

Public water supplies and others may call the following DEQ offices with questions about this assessment and to request assistance with developing and implementing a local protection plan. In addition, draft protection plans may be submitted to the DEQ office for preliminary review and comments.

| | |
|---|---|
| Boise Regional DEQ Office | (208) 373-0550 |
| State DEQ Office | (208) 373-0502 |

Website: http://www.deq.state.id.us

Water suppliers serving fewer than 10,000 persons may contact Melinda Harper, Idaho Rural Water Association, at 1-208-343-7001 for assistance with drinking water protection (formerly wellhead protection) strategies.

# POTENTIAL CONTAMINANT INVENTORY
# LIST OF ACRONYMS AND DEFINITIONS

**AST (Aboveground Storage Tanks) –** Sites with aboveground storage tanks.

**Business Mailing List –** This list contains potential contaminant sites identified through a yellow pages database search of standard industry codes (SIC).

**CERCLIS –** This includes sites considered for listing under the **Comprehensive Environmental Response Compensation and Liability Act (CERCLA)**. CERCLA, more commonly known as ASuperfund≅ is designed to clean up hazardous waste sites that are on the national priority list (NPL).

**Cyanide Site –** DEQ permitted and known historical sites/facilities using cyanide.

**Dairy –** Sites included in the primary contaminant source inventory represent those facilities regulated by Idaho State Department of Agriculture (ISDA) and may range from a few head to several thousand head of milking cows.

**Deep Injection Well –** Injection wells regulated under the Idaho Department of Water Resources generally for the disposal of stormwater runoff or agricultural field drainage.

**Enhanced Inventory** – Enhanced inventory locations are potential contaminant source sites added by the water system. These can include new sites not captured during the primary contaminant inventory, or corrected locations for sites not properly located during the primary contaminant inventory. Enhanced inventory sites can also include miscellaneous sites added by the Idaho Department of Environmental Quality (DEQ) during the primary contaminant inventory.

**Floodplain –** This is a coverage of the 100year floodplains.

**Group 1 Sites –** These are sites that show elevated levels of contaminants and are not within the priority one areas.

**Inorganic Priority Area –** Priority one areas where greater than 25% of the wells/springs show constituents higher than primary standards or other health standards.

**Landfill –** Areas of open and closed municipal and non-municipal landfills.

**LUST (Leaking Underground Storage Tank)** – Potential contaminant source sites associated with leaking underground storage tanks as regulated under RCRA.

**Mines and Quarries** – Mines and quarries permitted through the Idaho Department of Lands.)

**Nitrate Priority Area –** Area where greater than 25% of wells/springs show nitrate values above 5mg/l.

**NPDES (National Pollutant Discharge Elimination System) –** Sites with NPDES permits. The Clean Water Act requires that any discharge of a pollutant to waters of the United States from a point source must be authorized by an NPDES permit.

**Organic Priority Areas –** These are any areas where greater than 25 % of wells/springs show levels greater than 1% of the primary standard or other health standards.

**Recharge Point –** This includes active, proposed, and possible recharge sites on the Snake River Plain.

**RICRIS –** Site regulated under **Resource Conservation Recovery Act (RCRA)**. RCRA is commonly associated with the cradle to grave management approach for generation, storage, and disposal of hazardous wastes.

**SARA Tier II (Superfund Amendments and Reauthorization Act Tier II Facilities) –** These sites store certain types and amounts of hazardous materials and must be identified under the Community Right to Know Act.

**Toxic Release Inventory (TRI)** – The toxic release inventory list was developed as part of the Emergency Planning and Community Right to Know (Community Right to Know) Act passed in 1986. The Community Right to Know Act requires the reporting of any release of a chemical found on the TRI list.

**UST (Underground Storage Tank) –** Potential contaminant source sites associated with underground storage tanks regulated as regulated under RCRA.

**Wastewater Land Applications Sites** – These are areas where the land application of municipal or industrial wastewater is permitted by DEQ.

**Wellheads –** These are drinking water well locations regulated under the Safe Drinking Water Act. They are not treated as potential contaminant sources.

**NOTE:** Many of the potential contaminant sources were located using a geocoding program where mailing addresses are used to locate a facility. Field verification of potential contaminant sources is an important element of an enhanced inventory.

Where possible, a list of potential contaminant sites unable to be located with geocoding will be provided to water systems to determine if the potential contaminant sources are located within the source water assessment area.

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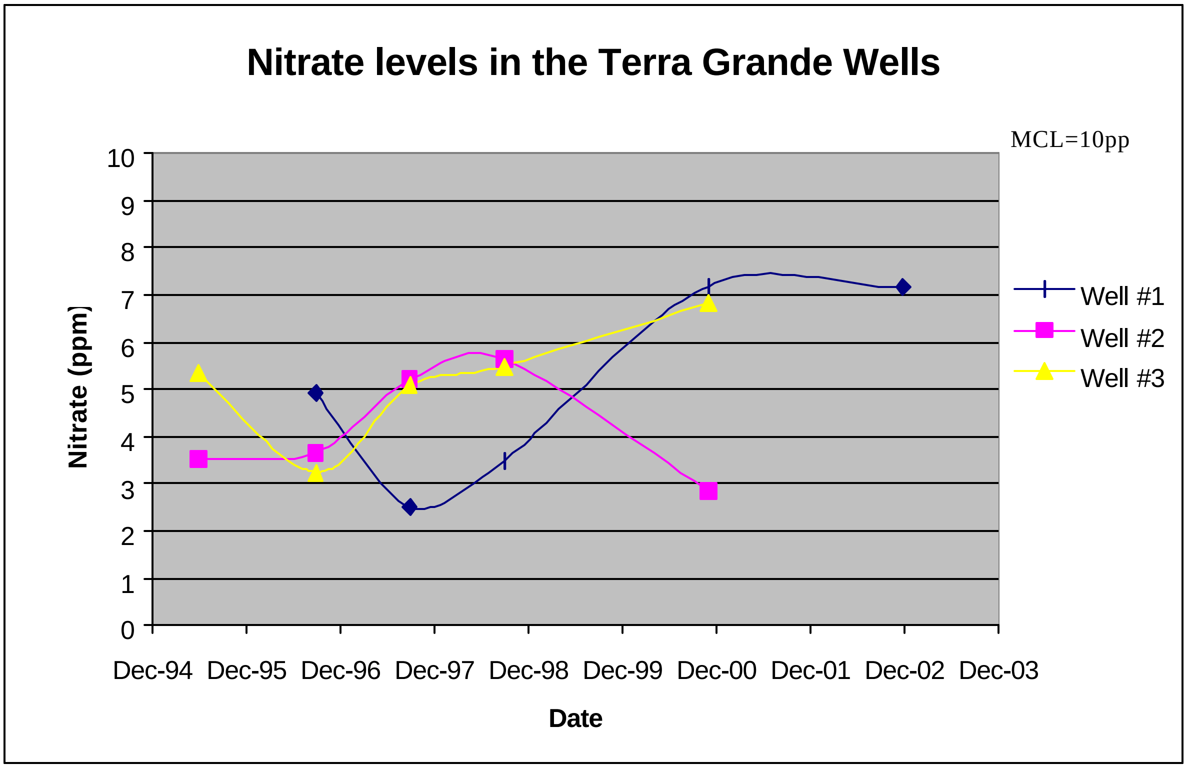
# Appendix A

## Graph 1
## Nitrate levels in the wells of the Terra Grande Water Company

**Graph 1. Nitrate concentrations in the Terra Grande Water Company Wells.**



# Appendix B

## Potential Contaminant Inventory
## Table 3
## Delineation Map
## Figure 2

**Table 3. Terra Grande Water Company, Wells #1, #2, #3, Potential Contaminant Inventory**

| SITE # | Source Description[1] | TOT Zone[2] (years) | Source of Information | Potential Contaminants[3] |
|---|---|---|---|---|
| 1 | UST – Closed | 0 – 3 | Database Search | VOC, SOC |
| 2 | Lawn & Garden Equipment & Supplie-Wholesale | 0 – 3 | Database Search | IOC, SOC |
| 3 | Material Handling Equipment (Wholesale) | 0 – 3 | Database Search | IOC, VOC, SOC |
| 4 | Contractors-Equip/Supls-Dlrs/Svc-Wholesale | 0 – 3 | Database Search | IOC, VOC, SOC |
| 5 | Hydraulic Equipment & Supplies (Wholesale) | 0 – 3 | Database Search | IOC, VOC, SOC |
| 6 | Contractors-Equip/Supls-Dlrs/Svc-Wholesale | 0 – 3 | Database Search | IOC, VOC, SOC |
| 7 | Automobile Repairing & Service | 0 – 3 | Database Search | IOC, VOC, SOC |
| 8 | Tire-Dealers-Retail | 0 – 3 | Database Search | VOC, SOC |
| 9 | Oils-Lubricating-Wholesale | 0 – 3 | Database Search | IOC, VOC, SOC |
| 10 | Machine Shops | 0 – 3 | Database Search | IOC, VOC, SOC |
| 11 | Welding | 0 – 3 | Database Search | IOC, VOC, SOC |
| 12 | Automobile Repairing & Service | 0 – 3 | Database Search | IOC, VOC, SOC |
| 13 | Roofing Contractors | 0 – 3 | Database Search | IOC, VOC, SOC |
| 14 | Air Courier Services | 0 – 3 | Database Search | IOC, VOC, SOC |
| 15 | Engines-Diesel-Fuel Injection | 0 – 3 | Database Search | IOC, VOC, SOC |
| 16 | Demolition Contractors | 0 – 3 | Database Search | IOC, SOC |
| 17 | Transportation | 0 – 3 | Database Search | IOC, VOC, SOC |
| 18, 42 | Paving Contractors; RCRA Site | 0 – 3 | Database Search | IOC, VOC, SOC |
| 19 | Four Wheel Drive-Repair & Service | 0 – 3 | Database Search | IOC, VOC, SOC |
| 20 | Automobile Parts & Supplies-Retail | 0 – 3 | Database Search | VOC, SOC |
| 21 | Landscape Contractors | 0 – 3 | Database Search | IOC, SOC, Microbials |
| 22 | General Contractors | 0 – 3 | Database Search | IOC, VOC, SOC |
| 23 | Roofing Contractors | 0 – 3 | Database Search | IOC, VOC, SOC |
| 24 | Truck-Repairing & Service | 0 – 3 | Database Search | IOC, VOC, SOC |
| 25 | Machine Shops | 0 – 3 | Database Search | IOC, VOC, SOC |
| 26 | Adhesives & Sealants (Manufacturer) | 0 – 3 | Database Search | IOC, VOC, SOC |
| 27 | Storage-Household & Commercial | 0 – 3 | Database Search | IOC, VOC, SOC, Microbials |
| 28 | Painters | 0 – 3 | Database Search | IOC, VOC, SOC |
| 29 | Industrial Measuring | 0 – 3 | Database Search | IOC, VOC, SOC |
| 30 | Pest Control | 0 – 3 | Database Search | IOC, VOC, SOC |
| 31, 47 | Welding Equipment & Supplies; SARA Site | 0 – 3 | Database Search | IOC, VOC, SOC |
| 32 | Automobile Parts & Supplies-Manufacturer | 0 – 3 | Database Search | IOC, VOC, SOC |
| 33 | Buildings-Metal | 0 – 3 | Database Search | IOC, VOC, SOC |
| 34 | Electronic Equipment & Supplies-Manufacturer | 0 – 3 | Database Search | IOC, VOC, SOC |
| 35 | Trailers-Truck (Wholesale) | 0 – 3 | Database Search | VOC, SOC |
| 36 | Janitor Service | 0 – 3 | Database Search | IOC, SOC, Microbials |
| 37 | Contractors | 0 – 3 | Database Search | IOC, VOC, SOC |

| SITE # | Source Description[1] | TOT Zone[2] (years) | Source of Information | Potential Contaminants[3] |
|---|---|---|---|---|
| 38 | Recycling Centers | 0 – 3 | Database Search | VOC |
| 39 | Electronic Equipment & Supplies-Manufacturer | 0 – 3 | Database Search | IOC, VOC, SOC |
| 40 | RCRA Site | 0 – 3 | Database Search | IOC, VOC, SOC |
| 41 | RCRA Site | 0 – 3 | Database Search | IOC, VOC, SOC |
| 43 | RCRA Site | 0 – 3 | Database Search | IOC, VOC, SOC |
| 44 | RCRA Site | 0 – 3 | Database Search | IOC, VOC, SOC |
| 45 | RCRA Site | 0 – 3 | Database Search | IOC, VOC, SOC |
| 46 | Mine-Gravel Pit | 0 – 3 | Database Search | IOC, VOC, SOC, Microbials |
| 48 | LUST-Site Cleanup Incomplete, Impact: Ground Water | 3 – 6 | Database Search | VOC, SOC |
| 49 | LUST-Site Cleanup Complete, Impact: Unknown | 3 – 6 | Database Search | VOC, SOC |
| 50, 54, 90 | LUST-Site Cleanup Incomplete, Impact: Unknown; UST-Closed; RCRA Site | 3 – 6 | Database Search | VOC, SOC |
| 51, 85 | UST-Closed; Roofing Contractors | 3 – 6 | Database Search | VOC, SOC |
| 52, 89 | UST-Closed; RCRA Site | 3 – 6 | Database Search | VOC, SOC |
| 53 | UST-Closed | 3 – 6 | Database Search | VOC, SOC |
| 55 | UST-Closed | 3 – 6 | Database Search | VOC, SOC |
| 56, 93 | UST-Open; SARA Site | 3 – 6 | Database Search | VOC, SOC |
| 57 | UST-Closed | 3 – 6 | Database Search | VOC, SOC |
| 58 | UST-Closed | 3 – 6 | Database Search | VOC, SOC |
| 59 | UST-Open | 3 – 6 | Database Search | VOC, SOC |
| 60 | Bathtubs & Sinks-Repairing & Refinishing | 3 – 6 | Database Search | IOC, VOC, SOC |
| 61 | Portable Toilets | 3 – 6 | Database Search | IOC, SOC |
| 62 | Contractors-Equipment & Supplies-Rental | 3 – 6 | Database Search | IOC, VOC, SOC |
| 63 | Carts-Motorized | 3 – 6 | Database Search | IOC, VOC, SOC |
| 64 | Automobile Renting & Leasing | 3 – 6 | Database Search | VOC, SOC |
| 65 | Coatings-Protective (Manufacturer) | 3 – 6 | Database Search | IOC, VOC, SOC |
| 66 | Asphalt & Asphalt Products | 3 – 6 | Database Search | VOC, SOC |
| 67 | Automobile Auctions (Wholesale) | 3 – 6 | Database Search | VOC, SOC |
| 68 | Motorcycles & Motor Scooters-Dealers | 3 – 6 | Database Search | VOC, SOC |
| 69 | Paving Contractors | 3 – 6 | Database Search | VOC, SOC |
| 70 | Automobile Parts & Supplies-Retail | 3 – 6 | Database Search | VOC, SOC |
| 71 | Automobile Dealers-New Cars | 3 – 6 | Database Search | VOC, SOC |
| 72 | Automobile Renting & Leasing | 3 – 6 | Database Search | VOC, SOC |
| 73 | Recreational Vehicles-Repairing | 3 – 6 | Database Search | IOC, VOC, SOC |
| 74 | Golf Course-Public | 3 – 6 | Database Search | IOC, SOC |
| 75 | Automobile Dealers-Used Cars | 3 – 6 | Database Search | VOC, SOC |
| 76 | Toilets-Portable | 3 – 6 | Database Search | IOC, SOC |
| 77 | Transmissions-Truck, Tractor | 3 – 6 | Database Search | IOC, VOC, SOC |
| 78 | Excavating Contractors | 3 – 6 | Database Search | IOC, VOC, SOC |
| 79 | Paving Contractors | 3 – 6 | Database Search | VOC, SOC |
| 80 | Aircraft Charter Rental & Leasing | 3 – 6 | Database Search | IOC, VOC, SOC |

| SITE # | Source Description[1] | TOT Zone[2] (years) | Source of Information | Potential Contaminants[3] |
|---|---|---|---|---|
| 81 | Trailers-Trucks (Wholesale) | 3 – 6 | Database Search | VOC, SOC |
| 82 | General Contractors | 3 – 6 | Database Search | IOC, VOC, SOC |
| 83 | Paving Contractors | 3 – 6 | Database Search | VOC, SOC |
| 84 | Fire Department Equipment & Supplies | 3 – 6 | Database Search | IOC, VOC, SOC |
| 86 | Septic Tanks-Cleaning & Repairing | 3 – 6 | Database Search | IOC, SOC |
| 87 | Mobile Homes-Transporting | 3 – 6 | Database Search | IOC, VOC, SOC |
| 88 | Parking Area Maintenance & Marking | 3 – 6 | Database Search | IOC, VOC, SOC` |
| 91 | RCRA Site | 3 – 6 | Database Search | IOC, VOC, SOC |
| 92 | RCRA Site | 3 – 6 | Database Search | IOC, VOC, SOC |
| 94, 119, 145 | LUST-Site Cleanup Incomplete, Impact: Ground Water, UST-Open, Automobile Renting & Leasing | 6 – 10 | Database Search | VOC, SOC |
| 95, 100, 116, 121, 125, 159, 177 | LUST-Site Cleanup Complete, Impact: Unknown; LUST-Site Cleanup Incomplete, Impact: Unknown; UST-Open; UST-Closed; Airports; RCRA Site; SARA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 96, 104, 132, 160, 179 | LUST-Site Cleanup Complete, Impact: Unknown; UST-Open; Air Transportation-Nonscheduled; RCRA Site; SARA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 97, 114, 124, 161 | LUST-Site Cleanup Complete, Impact: Unknown; UST-Open; Service Stations-Gasoline & Oil; RCRA Site | 6 – 10 | Database Search | VOC, SOC |
| 98, 109, 122, 181 | LUST-Site Cleanup Complete, Impact: Unknown; UST-Open; UST-Closed; SARA Site | 6 – 10 | Database Search | VOC, SOC |
| 99 | LUST-Site Cleanup Complete, Impact: Unknown | 6 – 10 | Database Search | VOC, SOC |
| 101 | LUST-Site Cleanup Incomplete, Impact: Unknown | 6 – 10 | Database Search | VOC, SOC |
| 102, 103, 176 | LUST-Site Cleanup Complete, Impact: Unknown; UST-Open; SARA Site | 6 – 10 | Database Search | VOC, SOC |
| 105 | UST-Open | 6 – 10 | Database Search | VOC, SOC |
| 106, 163 | UST-Closed; SARA Site | 6 – 10 | Database Search | VOC, SOC |
| 107, 133, 180 | UST-Open; Aircraft Servicing & Maintenance; SARA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 108 | UST-Closed | 6 – 10 | Database Search | VOC, SOC |
| 110, 144 | UST-Open; Automobile Renting & Leasing | 6 – 10 | Database Search | VOC, SOC |
| 111 | UST-Open | 6 – 10 | Database Search | VOC, SOC |
| 112 | UST-Open | 6 – 10 | Database Search | VOC, SOC |
| 113 | UST-Open | 6 – 10 | Database Search | VOC, SOC |

| SITE # | Source Description[1] | TOT Zone[2] (years) | Source of Information | Potential Contaminants[3] |
|---|---|---|---|---|
| 115, 128, 178 | UST-Open; Automobile Renting & Leasing; SARA Site | 6 – 10 | Database Search | VOC, SOC |
| 117 | UST-Open | 6 – 10 | Database Search | VOC, SOC |
| 118 | UST-Closed | 6 – 10 | Database Search | VOC, SOC |
| 120 | UST-Open | 6 – 10 | Database Search | VOC, SOC |
| 123 | Home Improvements | 6 – 10 | Database Search | IOC, VOC, SOC |
| 126 | Aircraft Equipment Parts & Supplies | 6 – 10 | Database Search | VOC, SOC |
| 127 | Semiconductor Devices (Manufacturer) | 6 – 10 | Database Search | IOC, VOC, SOC |
| 129 | General Contractors | 6 – 10 | Database Search | IOC, VOC, SOC |
| 130 | Taxidermists | 6 – 10 | Database Search | IOC, VOC, SOC |
| 131 | Aircraft Servicing & Maintenance | 6 – 10 | Database Search | IOC, VOC, SOC |
| 134, 135 | Automobile Renting & Leasing | 6 – 10 | Database Search | VOC, SOC |
| 136 | Boat Repairing | 6 – 10 | Database Search | IOC, VOC, SOC |
| 137 | Conveyors &Conveying Equipment | 6 – 10 | Database Search | IOC, VOC, SOC |
| 138, 175 | Air Cargo Service; SARA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 139 | Automobile Renting & Leasing | 6 – 10 | Database Search | VOC, SOC |
| 140 | Aircraft Servicing & Maintenance | 6 – 10 | Database Search | IOC, VOC, SOC |
| 141 | Air Cargo Service | 6 – 10 | Database Search | IOC, VOC, SOC |
| 142 | Furniture-Repairing & Refinishing | 6 – 10 | Database Search | IOC, VOC, SOC |
| 143 | Oils-Petroleum-Retail | 6 – 10 | Database Search | VOC, SOC |
| 146 | Air Cargo Service | 6 – 10 | Database Search | IOC, VOC, SOC |
| 147 | Aircraft Charter Rental & Leasing | 6 – 10 | Database Search | IOC, VOC, SOC |
| 148 | Aircraft Charter Rental & Leasing | 6 – 10 | Database Search | IOC, VOC, SOC |
| 149 | Air Cargo Service | 6 – 10 | Database Search | IOC, VOC, SOC |
| 150 | State Government-Transportation Program | 6 – 10 | Database Search | IOC, VOC, SOC |
| 151 | Aircraft-Dealers | 6 – 10 | Database Search | IOC, VOC, SOC |
| 152 | Bus Lines | 6 – 10 | Database Search | IOC, VOC, SOC |
| 153 | Aircraft Charter Rental & Leasing | 6 – 10 | Database Search | IOC, VOC, SOC |
| 154 | Federal Government-Transportation Program | 6 – 10 | Database Search | IOC, VOC, SOC |
| 155 | Federal Government-Transportation Program | 6 – 10 | Database Search | IOC, VOC, SOC |
| 156, 157 | Federal Government-Transportation Program | 6 – 10 | Database Search | IOC, VOC, SOC |
| 158 | Air Cargo Service | 6 – 10 | Database Search | IOC, VOC, SOC |
| 162 | RCRA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 164 | RCRA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 165 | RCRA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 166, 167 | RCRA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 168 | RCRA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 169 | Mine-Gravel Pit | 6 – 10 | Database Search | IOC, VOC, SOC |
| 170 | Mine-Gravel Pit | 6 – 10 | Database Search | IOC, VOC, SOC |
| 171 | SARA Site | 6 – 10 | Database Search | VOC, SOC |
| 172 | SARA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 173 | SARA Site | 6 – 10 | Database Search | IOC, VOC, SOC |
| 174 | SARA Site | 6 – 10 | Database Search | IOC, VOC, SOC |

| SITE # | Source Description[1] | TOT Zone[2] (years) | Source of Information | Potential Contaminants[3] |
|---|---|---|---|---|
| 182 | SARA Site-Water Supply | 6 – 10 | Database Search | IOC, SOC |
| | Interstate 84 | 0 – 10 | GIS Map | IOC, VOC, SOC, Microbials |
| | New York Canal | 3 – 6 | GIS Map | IOC, VOC, SOC |

**[1] UST = underground storage tank, LUST = leaking underground storage tank, RCRA = Resource Conservation and Recovery Act, SARA = Superfund Amendments and Reauthorization Act**
**[2] TOT = time-of-travel (in years) for a potential contaminant to reach the wellhead**
**[3] IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical**

# Appendix C

# Terra Grande Water Company Susceptibility Analysis Worksheets

The final scores for the susceptibility analysis were determined using the following formulas:

1) VOC/SOC/IOC Final Score = Hydrologic Sensitivity + System Construction + (Potential Contaminant/Land Use x 0.2)

2) Microbial Final Score = Hydrologic Sensitivity + System Construction + (Potential Contaminant/Land Use x 0.375)

Final Susceptibility Scoring:

0 - 5 Low Susceptibility

6 - 12 Moderate Susceptibility

≥ 13 High Susceptibility

Ground Water Susceptibility Report    Public Water System Name : TERRA GRANDE WATER COMPANY    Well# : WELL #1 HATCH

Public Water System Number 4010147    4/24/02 10:24:04 AM

## 1. System Construction

| | | SCORE |
|---|---|---|
| Drill Date | 1957 | |
| Driller Log Available | YES | |
| Sanitary Survey (if yes, indicate date of last survey) | YES | 1994 |
| Well meets IDWR construction standards | NO | 1 |
| Wellhead and surface seal maintained | YES | 0 |
| Casing and annular seal extend to low permeability unit | NO | 2 |
| Highest production 100 feet below static water level | NO | 1 |
| Well located outside the 100 year flood plain | NO | 1 |
| Total System Construction Score | | 5 |

## 2. Hydrologic Sensitivity

| | | |
|---|---|---|
| Soils are poorly to moderately drained | NO | 2 |
| Vadose zone composed of gravel, fractured rock or unknown | YES | 1 |
| Depth to first water > 300 feet | NO | 1 |
| Aquitard present with > 50 feet cumulative thickness | YES | 0 |
| Total Hydrologic Score | | 4 |

## 3. Potential Contaminant / Land Use - ZONE 1A

| | | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|---|
| Land Use Zone 1A | URBAN/COMMERCIAL | 2 | 2 | 2 | 2 |
| Farm chemical use high | NO | 0 | 0 | 0 | |
| IOC, VOC, SOC, or Microbial sources in Zone 1A | YES | NO | YES | NO | NO |
| Total Potential Contaminant Source/Land Use Score - Zone 1A | | 2 | 2 | 2 | 2 |

### Potential Contaminant / Land Use - ZONE 1B

| | | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|---|
| Contaminant sources present (Number of Sources) | YES | 41 | 43 | 46 | 4 |
| (Score = # Sources X 2 ) 8 Points Maximum | | 8 | 8 | 8 | 8 |
| Sources of Class II or III leacheable contaminants or | YES | 5 | 5 | 5 | |
| 4 Points Maximum | | 4 | 4 | 4 | |
| Zone 1B contains or intercepts a Group 1 Area | YES | 2 | 0 | 2 | 0 |
| Land use Zone 1B | Less Than 25% Agricultural Land | 0 | 0 | 0 | 0 |
| Total Potential Contaminant Source / Land Use Score - Zone 1B | | 14 | 12 | 14 | 8 |

### Potential Contaminant / Land Use - ZONE II

| | | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|---|
| Contaminant Sources Present | YES | 2 | 2 | 2 | |
| Sources of Class II or III leacheable contaminants or | YES | 1 | 1 | 1 | |
| Land Use Zone II | Less than 25% Agricultural Land | 0 | 0 | 0 | |
| Potential Contaminant Source / Land Use Score - Zone II | | 3 | 3 | 3 | 0 |

### Potential Contaminant / Land Use - ZONE III

| | | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|---|
| Contaminant Source Present | YES | 1 | 1 | 1 | |
| Sources of Class II or III leacheable contaminants or | YES | 1 | 1 | 1 | |
| Is there irrigated agricultural lands that occupy > 50% of | NO | 0 | 0 | 0 | |
| Total Potential Contaminant Source / Land Use Score - Zone III | | 2 | 2 | 2 | 0 |

| | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|
| Cumulative Potential Contaminant / Land Use Score | 21 | 19 | 21 | 10 |
| 4. Final Susceptibility Source Score | 13 | 13 | 13 | 13 |
| 5. Final Well Ranking | High | High | High | High |

Ground Water Susceptibility Report    Public Water System Name : TERRA GRANDE WATER COMPANY    Well# : WELL#2 ASH PARK
Public Water System Number 4010147    4/24/02 10:26:54 AM

## 1. System Construction

| | | SCORE |
|---|---|---|
| Drill Date | 1957 | |
| Driller Log Available | NO | |
| Sanitary Survey (if yes, indicate date of last survey) | YES | 1994 |
| Well meets IDWR construction standards | NO | 1 |
| Wellhead and surface seal maintained | NO | 1 |
| Casing and annular seal extend to low permeability unit | NO | 2 |
| Highest production 100 feet below static water level | NO | 1 |
| Well located outside the 100 year flood plain | NO | 1 |
| Total System Construction Score | | 6 |

## 2. Hydrologic Sensitivity

| | | |
|---|---|---|
| Soils are poorly to moderately drained | NO | 2 |
| Vadose zone composed of gravel, fractured rock or unknown | YES | 1 |
| Depth to first water > 300 feet | NO | 1 |
| Aquitard present with > 50 feet cumulative thickness | NO | 2 |
| Total Hydrologic Score | | 6 |

## 3. Potential Contaminant / Land Use - ZONE 1A

| | | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|---|
| Land Use Zone 1A | URBAN/COMMERCIAL | 2 | 2 | 2 | 2 |
| Farm chemical use high | NO | 0 | 0 | 0 | |
| IOC, VOC, SOC, or Microbial sources in Zone 1A | YES | YES | YES | YES | YES |
| Total Potential Contaminant Source/Land Use Score - Zone 1A | | 2 | 2 | 2 | 2 |

### Potential Contaminant / Land Use - ZONE 1B

| | | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|---|
| Contaminant sources present (Number of Sources) | YES | 41 | 43 | 46 | 4 |
| (Score = # Sources X 2 ) 8 Points Maximum | | 8 | 8 | 8 | 8 |
| Sources of Class II or III leacheable contaminants or | YES | 4 | 5 | 5 | |
| 4 Points Maximum | | 4 | 4 | 4 | |
| Zone 1B contains or intercepts a Group 1 Area | YES | 2 | 0 | 2 | 0 |
| Land use Zone 1B | Less Than 25% Agricultural Land | 0 | 0 | 0 | 0 |
| Total Potential Contaminant Source / Land Use Score - Zone 1B | | 14 | 12 | 14 | 8 |

### Potential Contaminant / Land Use - ZONE II

| | | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|---|
| Contaminant Sources Present | YES | 2 | 2 | 2 | |
| Sources of Class II or III leacheable contaminants or | YES | 1 | 1 | 1 | |
| Land Use Zone II | Less than 25% Agricultural Land | 0 | 0 | 0 | |
| Potential Contaminant Source / Land Use Score - Zone II | | 3 | 3 | 3 | 0 |

### Potential Contaminant / Land Use - ZONE III

| | | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|---|
| Contaminant Source Present | YES | 1 | 1 | 1 | |
| Sources of Class II or III leacheable contaminants or | YES | 1 | 1 | 1 | |
| Is there irrigated agricultural lands that occupy > 50% of | NO | 0 | 0 | 0 | |
| Total Potential Contaminant Source / Land Use Score - Zone III | | 2 | 2 | 2 | 0 |

| | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|
| Cumulative Potential Contaminant / Land Use Score | 21 | 19 | 21 | 10 |
| 4. Final Susceptibility Source Score | 16 | 16 | 16 | 16 |
| 5. Final Well Ranking | High | High | High | High |

Ground Water Susceptibility Report  Public Water System Name : TERRA GRANDE WATER COMPANY  Well# : WELL#3 PENNIGER
Public Water System Number 4010147  4/24/02 10:24:24 AM

## 1. System Construction

| | | SCORE |
|---|---|---|
| Drill Date | 1957 | |
| Driller Log Available | YES | |
| Sanitary Survey (if yes, indicate date of last survey) | YES | 1994 |
| Well meets IDWR construction standards | NO | 1 |
| Wellhead and surface seal maintained | YES | 0 |
| Casing and annular seal extend to low permeability unit | NO | 2 |
| Highest production 100 feet below static water level | NO | 1 |
| Well located outside the 100 year flood plain | NO | 1 |
| Total System Construction Score | | 5 |

## 2. Hydrologic Sensitivity

| | | |
|---|---|---|
| Soils are poorly to moderately drained | NO | 2 |
| Vadose zone composed of gravel, fractured rock or unknown | YES | 1 |
| Depth to first water > 300 feet | NO | 1 |
| Aquitard present with > 50 feet cumulative thickness | YES | 0 |
| Total Hydrologic Score | | 4 |

## 3. Potential Contaminant / Land Use - ZONE 1A

| | | IOC Score | VOC Score | SOC Score | Microbial Score |
|---|---|---|---|---|---|
| Land Use Zone 1A | URBAN/COMMERCIAL | 2 | 2 | 2 | 2 |
| Farm chemical use high | NO | 0 | 0 | 0 | |
| IOC, VOC, SOC, or Microbial sources in Zone 1A | YES | NO | YES | NO | NO |
| Total Potential Contaminant Source/Land Use Score - Zone 1A | | 2 | 2 | 2 | 2 |

### Potential Contaminant / Land Use - ZONE 1B

| | | IOC | VOC | SOC | Microbial |
|---|---|---|---|---|---|
| Contaminant sources present (Number of Sources) | YES | 41 | 43 | 46 | 4 |
| (Score = # Sources X 2 ) 8 Points Maximum | | 8 | 8 | 8 | 8 |
| Sources of Class II or III leacheable contaminants or | YES | 5 | 5 | 5 | |
| 4 Points Maximum | | 4 | 4 | 4 | |
| Zone 1B contains or intercepts a Group 1 Area | YES | 2 | 0 | 2 | 0 |
| Land use Zone 1B | Less Than 25% Agricultural Land | 0 | 0 | 0 | 0 |
| Total Potential Contaminant Source / Land Use Score - Zone 1B | | 14 | 12 | 14 | 8 |

### Potential Contaminant / Land Use - ZONE II

| | | IOC | VOC | SOC | Microbial |
|---|---|---|---|---|---|
| Contaminant Sources Present | YES | 2 | 2 | 2 | |
| Sources of Class II or III leacheable contaminants or | YES | 1 | 1 | 1 | |
| Land Use Zone II | Less than 25% Agricultural Land | 0 | 0 | 0 | |
| Potential Contaminant Source / Land Use Score - Zone II | | 3 | 3 | 3 | 0 |

### Potential Contaminant / Land Use - ZONE III

| | | IOC | VOC | SOC | Microbial |
|---|---|---|---|---|---|
| Contaminant Source Present | YES | 1 | 1 | 1 | |
| Sources of Class II or III leacheable contaminants or | YES | 1 | 1 | 1 | |
| Is there irrigated agricultural lands that occupy > 50% of | NO | 0 | 0 | 0 | |
| Total Potential Contaminant Source / Land Use Score - Zone III | | 2 | 2 | 2 | 0 |

| | IOC | VOC | SOC | Microbial |
|---|---|---|---|---|
| Cumulative Potential Contaminant / Land Use Score | 21 | 19 | 21 | 10 |
| 4. Final Susceptibility Source Score | 13 | 13 | 13 | 13 |
| 5. Final Well Ranking | High | High | High | High |